

COASTAL BASIN
NORTON, MASSACHUSETTS

NORTON RESERVOIR DAM

MA 00815

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS 02154

AUGUST 1978

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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KEY WORDS (Continue on reverse side if necessary and identify by block number) DAMS, INSPECTION, DAM SAFETY, Coastal Basin Norton, Massachusetts Rumford River		
ABSTRACT (Continue on reverse side if necessary and identify by block number) The complex spillway is 77 ft. long and stands 12 ft. above stream bed at its lowest point. There are several houses close to the water's edge and in the watercourse downstream of the dam. The structure appears to be in fair condition, as is the left abutment and gatehouse. Owing to the impoundment storage, the dam falls within the intermediate size category. The hazard potential is significant. A failure of the dam coincident with full spillway discharge could result in a flow of about 7000 cfs.		

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:
NEDED

SEP 28 1978

Honorable Michael S. Dukakis
Governor of the Commonwealth of
Massachusetts
State House
Boston, Massachusetts 02133

Dear Governor Dukakis:

I am forwarding to you a copy of the Norton Reservoir Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

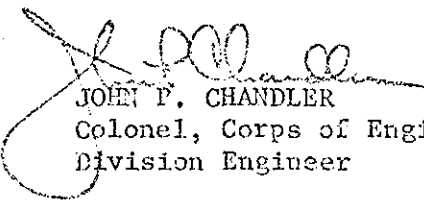
A copy of this report has been forwarded to the Department of Environmental Quality Engineering, the cooperating agency for the Commonwealth of Massachusetts. In addition, a copy of the report has also been furnished the owner, The Wading Reservoir Corporation, 620 Spring Street, North Dighton, Massachusetts 02764.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Quality Engineering for your cooperation in carrying out this program.

Sincerely yours,

Incl
As stated


JOHN F. CHANDLER
Colonel, Corps of Engineers
Division Engineer

NORTON RESERVOIR DAM

MA 00815

COASTAL BASIN
NORTON, MASSACHUSETTS

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

Identification No.: MA 00815
Name of Dam: Norton Reservoir Dam
Town: Norton, Massachusetts
County and State: Bristol County, Massachusetts
Stream: Rumford River
Date of Inspection: June 12, 1978

BRIEF ASSESSMENT

The Norton Reservoir Dam is an almost 80-year old concrete overflow structure with earthfill abutments behind concrete wing walls. No details of the design or construction are known. The complex spillway is 77 feet long and stands 12 feet above stream bed at its lowest point. Freeboard between this level and the top of the dam is 4 to 5 feet. The reservoir is used for industrial purposes. There are several houses close to the water's edge and in the watercourse downstream of the dam. Water is released in the Spring and Fall of the year in anticipation of high flows.

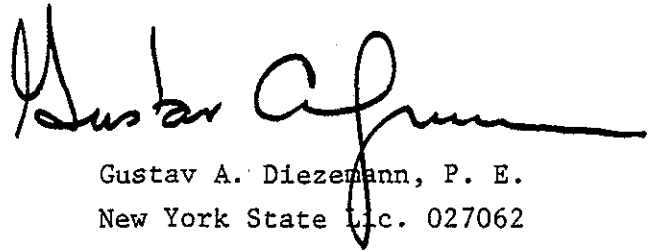
The structure appears to be in fair condition, as is the left abutment and gatehouse. The right abutment shows signs of erosion and could well be the first section to fail.

Owing to the impoundment storage, Norton Reservoir Dam falls within the intermediate size classification. It is in the significant hazard potential category and thus hydraulically analyzed using the full probable maximum flood.

Reservoir storage will reduce the probable maximum discharge of 10,970 cfs to a test flood of 9,300 cfs. The spillway can pass, before overtopping, about 1,600 cfs (17 percent of the test flood). In the event of the test flood, the abutments would be overtopped by some 3 to 4 feet. Failure of the dam during test flood would not materially increase the flow as water level immediately downstream at that time would be within a few feet of the spillway crest.

A failure of the dam coincident with full spillway discharge could result in a flow of about 7,000 cfs. Such a flow might cause flooding in dwellings on the banks of the watercourse but would not, it appears, cause major damage or threaten human life.

Additional investigations or major modifications are not required. However, the owner should implement inspection and maintenance procedures, make repairs as required, clear the watercourse immediately downstream of the dam of growth and debris, restore the right abutment to true dimensions, and develop a flood warning system.



Gustav A. Diezemann, P. E.
New York State Lic. 027062

This Phase I Inspection Report on Norton Reservoir Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.



CHARLES G. TIERSCH, Chairman
Chief, Foundation and Materials Branch
Engineering Division

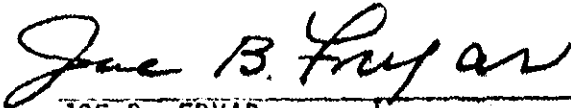


FRED J. RAVENS, Jr., Member
Chief, Design Branch
Engineering Division



SAUL COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:



JOE B. FRYAR
Chief, Engineering Division AUG 4 1978

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

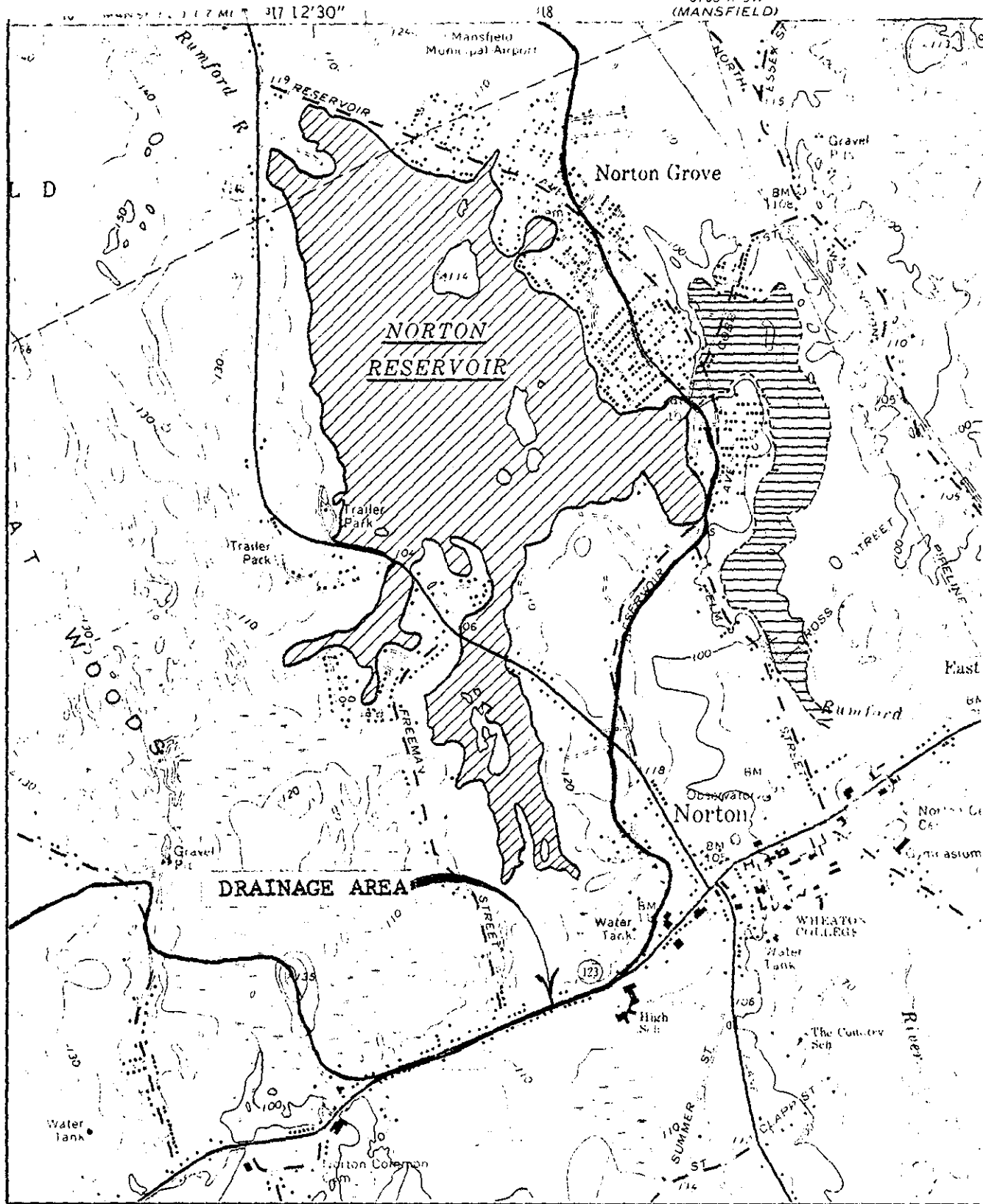
Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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OVERVIEW PHOTO



NORTON RESERVOIR

NORTON, MASS.
Scale 1:24000

PHASE I INSPECTION REPORT

NORTON RESERVOIR DAM

SECTION I

PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Chas. T. Main, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Authorization and notice to proceed were issued to Chas. T. Main, Inc. under a letter of May 3, 1978, from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW33-78-D328 has been assigned by the Corps of Engineers for this work.

b. Purpose.

(1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) Encourage and prepare the states to initiate quickly effective dam safety programs for non-Federal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location. The Norton Reservoir Dam on the Rumford River is in the Town of Norton, Bristol County, Massachusetts.

b. Description of Dam and Appurtenances. The dam consists of a complex (see calculations) concrete gravity overflow section, 77 feet wide, with earthfill abutments behind concrete wing walls. If the dam is overtopped, these abutments and their natural extensions amount to effective discharge lengths of 100 feet and 250 feet on the right and left banks, respectively. The lowest overflow section is 12 feet above

stream bed. Controls for two sluice gates are housed in a small structure on the left abutment.

c. Size Classification. Owing to its storage capacity of about 3600 acre feet, the dam falls within the intermediate size classification.

d. Hazard Classification. As there are only a small number of houses downstream of the dam which could be endangered if the dam failed, the dam is considered to have a significant hazard potential.

e. Ownership. The dam is owned by the Wading River Reservoir Corporation located at 620 Spring Street, North Dighton, Massachusetts.

f. Operator. Mr. Joseph Coelho
613 School Street, North Dighton, Mass.
Home: (617) 823-3602. Office: (617) 824-7511

g. Purpose of Dam. The water impounded by the dam is used for industrial purposes downstream of the dam.

h. Design and Construction History. Nothing is known of the design and construction history of the dam, other than it was constructed about 1900.

i. Normal Operating Procedures. In anticipation of increased flows, water is released and the reservoir drawn down in the Spring and Fall of the year.

1.3 Pertinent Data

a. Drainage Area. The Norton Reservoir has approximately 18.72 square miles of drainage area of essentially flat, marshy, partially forested rural land.

b. Discharge at Damsite.

(1) The outlet works consist of two 30-inch diameter conduits controlled by sluice gates. This equipment was overhauled by the owner as recently as two years ago.

(2) The magnitude of the maximum flood which has occurred at the damsite is unknown.

(3) The ungated spillway capacity before the dam is overtopped is about 1,600 cfs, or approximately 17 percent of the test flood.

(4) There is no gated spillway capacity.

(5) There is no gated spillway capacity.

(6) The total spillway capacity at maximum pool elevation is 1,600 cfs at El. 105.

c. Elevation (Feet Above MSL)

(1)	Top of dam	El. 106
(2)	Maximum design surcharge	El. 106
(3)	Full flood control pool	N/A
(4)	Recreation pool	N/A
(5)	Spillway crest (gated)	El. 101 (ungated)
(6)	Upstream portal invert diversion tunnel	N/A
(7)	Streambed at centerline of dam	El. 89 \pm
(8)	Maximum tailwater	El. 98 \pm

d. Reservoir (Feet)

(1)	Length of maximum pool	11,000 \pm
(2)	Length of recreation pool	N/A
(3)	Length of flood control pool	N/A

e. Storage (Acre-Feet)

(1)	Recreation pool	3,600 \pm
(2)	Flood control pool	N/A
(3)	Design surcharge	6,000 \pm
(4)	Top of dam	6,000 \pm

f. Reservoir Surface (Acres)

(1)	Top of dam	816 \pm
(2)	Maximum pool	816 \pm
(3)	Flood control pool	N/A
(4)	Recreation pool	N/A
(5)	Spillway crest	600

g. Dam

(1)	Type	Concrete
(2)	Length	77 \pm feet plus abutments
(3)	Height	17 \pm feet
(4)	Top Width	Varies
(5)	Side slope	N/A
(6)	Zoning	N/A
(7)	Impervious core	N/A
(8)	Cutoff	Unknown
(9)	Grout curtain	Unknown
(10)	Other	N/A

h. Spillway

(1)	Type	Compound ungated weir
(2)	Length of weir	77 \pm
(3)	Crest elevation	Lowest section El. 101 \pm
(4)	Gates	None
(5)	U/S Channel	N/A
(6)	D/S Channel	Stream bed
(7)	General	N/A

i. Regulating Outlets. The outlet works consist of two 36-inch diameter conduits controlled by manually operated sluice gates.

SECTION 2
ENGINEERING DATA

2.1 Design

No design data exist.

2.2 Construction

There are no construction records available.

2.3 Operation

Other than it is known that the reservoir is drawn down in the Spring and Fall, no operation data exist.

2.4 Evaluation

a. Availability. There are no engineering data available.

b. Adequacy. The lack of in-depth engineering data does not allow for a definitive review. Therefore, the adequacy of this dam, structurally and hydraulically, cannot be assessed from the standpoint of review of design calculations, but must be based primarily on the visual inspection, past performance history, and sound hydrologic and hydraulic engineering judgment.

c. Validity. The limited data available do not furnish a proper basis for a detailed evaluation of this dam.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General. The Norton Reservoir Dam, considering its age of almost 80 years, is in fair condition. It is virtually impossible to ascertain where the embankment or fill behind the concrete wing walls ends and the natural grade begins.

b. Dam. The concrete, although old and weathered, appears to be structurally sound. Small amounts of seepage were observed at the wing walls. No significant horizontal or vertical misalignments were noticeable. The left abutment appears sound and well maintained. The right abutment is easily accessible to the public and shows signs of usage, there being footpaths and some erosion on the downstream slope.

c. Appurtenant Structures. The only appurtenant structure, the gatehouse, is in fair condition.

d. Reservoir Area. The banks are flat and wooded. There are several houses close to the water's edge.

e. Downstream Channel. The channel immediately downstream of the dam is rocky and partially filled with trees and other vegetation. There are several houses just downstream of the left abutment and its natural extension. About 100 yards downstream of the dam is a highway bridge. Beyond the bridge the stream follows a comparatively narrow course, with houses on either bank, before discharging into a broad, semi-wooded marsh which continues downstream at a right angle to the original flow. There are several houses on the periphery of the marsh and a small industrial pond and factory on the river course.

3.2 Evaluation

Based on visual observations during the site evaluation, the general condition of the project is fair. The deterioration which has taken place is normal and, with proper maintenance, should not affect the integrity of the structure.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures

The slide gates are usually opened in the Spring and Fall of the year in anticipation of the comparatively higher runoffs at these times.

4.2 Maintenance of Dam

There appear to be no definite maintenance procedures of the dam in effect.

4.3 Maintenance of Operating Facilities

The gates are apparently kept in working order. The owner stated that they were overhauled as recently as two years ago.

4.4 Warning System

There is no warning system.

4.5 Evaluation

The lowering of the pond level in anticipation of high runoff is an attempt, and probably all that can be done practically, to mitigate the effects of potential floods. Maintenance, while it does exist, could be improved upon. Recommendations for improving these conditions are given in Section 7.3.

SECTION 5

HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data. The hydraulic/hydrologic analysis was made in accordance with "Preliminary Guidance for Estimating Maximum Probable Discharges in Phase I Dam Safety Investigations", "Estimating Effect of Surge Storage on Maximum Probable Discharges", and "Rule of Thumb Guidance for Estimating Downstream Dam Failure Hydrographs" as furnished by the New England Division, Corps of Engineers and "Recommended Guidelines for Safety Inspection of Dams" as issued by the Department of the Army, Office of the Chief of Engineers.

U.S.G.S. Quadrangle maps were used to determine reservoir and drainage areas. Where practicable, spillway dimensions were obtained by direct measurement. Hydraulic coefficients were assigned on the basis of experience and engineering judgment.

b. Experience Data. No specific experience data with respect to the hydraulic/hydrological characteristics of the project are known to exist.

c. Visual Observations

The right abutment section appeared to be slightly lower than the left. Accurate measurements were not possible. For the purpose of hydraulic analysis, the right abutment was assumed to be one foot lower than the left. It was observed that high flows would obviously discharge over a length greater than the dam itself. A total effective length, including the spillway, of 427 feet was assumed. It is virtually impossible to determine where the embankment, or fill behind the retaining walls, ends and the natural abutments begin.

d. Overtopping Potential. A Probable Maximum Flood (PMF) of 10,970 cfs was determined. Owing to its intermediate size and significant hazard classifications, the PMF was used in the determination of the Peak Outflow (or test flood) of 9,300 cfs. The spillway capacity, before overtopping, is about 1,600 cfs and such a flow would overtop the right abutment by about 4 feet and the left abutment by about 3 feet. It is doubtful that the dam, especially the right abutment, could withstand overtopping for very long. At the test flood, however, the water level immediately downstream of the dam would be within a few feet of the spillway crest elevation, thus a failure of the dam would have little effect on the total discharge.

The Peak Failure Outflow, assuming a 50-foot breach in the right abutment, of 5,400 cfs combined with the spillway discharge at full pond, results in a flow of about 7,000 cfs.

Downstream of the dam is a highway bridge under which there is a channel of about 500 square feet. This may possibly act as a control section, but would have little influence on downstream conditions. As the flood flow enters the marsh, water levels could rise as high as El. 97, thus causing flooding and possible damage to low lying houses. Owing to receding grade and the effect of storage, the water level would gradually drop to about El. 95 in the second reach. This elevation could cause some flooding damage to some residences on Cobb Street and the easternmost homes located off Reservoir Avenue, but no hazard to human life. The third and fourth reaches dissipate the flow to a level of approximately El. 93. These reaches are in a broad, marshy flood plain, with little property damage possible. The fifth reach was assumed to end at Cross Street, which was assumed to be a broad-crested weir, backing water up to El. 90 throughout reach 5, flooding a few homes and a small factory. At this time, the peak would have dropped off greatly as the channel from Cross Street to the dam has upwards of 25 percent of the volume of the reservoir. The channel downstream of Cross Street could carry the outflow of reach 5 with a low potential of hazard to life and property.

The areas of impact immediately downstream of the dam are shown on the location map.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations. Nothing was noted which would indicate that the dam was unstable.

b. Design and Construction Data. No design or construction data are available.

c. Operating Records. Not applicable.

d. Post Construction Changes. No post construction changes are known to have been made.

e. Seismic Stability. This dam is located in Seismic Zone 2 and therefore a seismic analysis is not required according to the recommended guidelines.

SECTION 7

ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. This almost 80-year old concrete and fill structure appears to be in fair condition. While there are signs of normal aging and deterioration, there are no indications of structural distress.

b. Adequacy of Information. The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and engineering judgment.

c. Urgency. The required repair and maintenance work should be accomplished within one to two years of the receipt of this report by the owner.

d. Need for Additional Investigation. There is no need for additional investigation.

7.2 Recommendations

Additional engineering investigations or major modifications to the dam are not required.

7.3 Remedial Measures

a. Alternatives. Not applicable.

b. Operation and Maintenance Procedures. The owner of the dam should develop and implement procedures which would include periodic inspection of the dam for signs of distress, deterioration or vandalism. Repairs and restorations should be made, where required, and the spillway should be periodically cleaned of growth and debris.

Presently required maintenance includes repair of spalled concrete and the clearing of growth and debris from the channel between the dam and the highway bridge downstream of the dam.

The right abutment should be brought to true grade and eroded areas on the downstream slope suitably filled. Removal of growth

would serve no purpose but would, rather, provide an opportunity for damage by motorbikes or other destructive forces.

Around the clock surveillance should be provided by the owner during periods of unusually heavy precipitation. The owner should develop a formal warning system with local officials for alerting downstream residents in case of emergency.

APPENDIX A

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT NORTON RESERVOIR

DATE JUNE 12, 1978

TIME 12:30 P.M.

WEATHER CLEAR & SUNNY

W.S. ELEV. 101 U.S. DN.S

PARTY:

1. J. Goodrich
2. D. Fischer
3.
4.
5.

PROJECT FEATURE

INSPECTED BY

REMARKS

- | PROJECT FEATURE | INSPECTED BY | REMARKS |
|---|---|---|
| 1. <u> </u> | <u> </u> | <u> </u> |
| 2. <u> </u> | <u> </u> | <u> </u> |
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| 10. <u> </u> | <u> </u> | <u> </u> |

INSPECTION CHECK LIST

PROJECT NORTON RESERVOIR

DATE _____

PROJECT FEATURE _____

NAME _____

AREA EVALUATED	CONDITION
<u>DIKE EMBANKMENT (AT ENDS OF DAM)</u>	
Crest Elevation	
Current Pool Elevation	101
Surface Cracks	None
Pavement Condition	No pavement
Movement of Settlement of Crest	None
Lateral Movement	None
Vertical Alignment	O.K.
Horizontal Alignment	O.K.
Condition at Abutment and at Concrete Structures	O.K.
Indications of Movement of Structural Items on Slopes	No movement
Trespassing on Slopes	None
Sloughing or Erosion of Slopes or Abutments	
Rock Slope Protection - Riprap Failures	
Unusual Movement or Cracking at or near Toes	
Unusual Embankment or Downstream Seepage	
Piping or Boils	None
Foundation Drainage Features	
Toe Drains	No toe drains
Instruments on System	

INSPECTION CHECK LIST

PROJECT NORTON RESERVOIR

DATE _____

PROJECT FEATURE _____

NAME _____

AREA EVALUATED	CONDITION
<u>CONCRETE DAM</u>	
Concrete Surfaces	<i>weathered, some spalling on surface</i>
Structural Cracking	<i>None</i>
Movement -- Horizontal & Vertical Alignment	<i>None observed</i>
Junctions	<i>some spalling and open joints</i>
Drains -- Foundation, Joint, Face	<i>none</i>
Water Passages	<i>-low level sluice - two outlets one discharging</i>
Seepage or Leakage	<i>~ slight amount of seepage at outlet wing walls</i>
Monolith Joints -- Construction Joints	
Foundation	

INSPECTION CHECK LIST

PROJECT NORTON RESERVOIR

DATE _____

PROJECT FEATURE _____

NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - INTAKE CHANNEL AND</u> <u>INTAKE STRUCTURE</u>	
a. Approach Channel	
Slope Conditions	
Bottom Conditions	
Rock Slides or Falls	<i>None</i>
Log Boom	<i>None</i>
Debris	<i>None</i>
Condition of Concrete Lining	<i>some spalling</i>
Drains or Weep Holes	<i>None</i>
b. Intake Structure	<i>Gate House</i>
Condition of Concrete	<i>O.K</i>
Stop Logs and Slots	<i>None</i>

INSPECTION CHECK LIST

PROJECT NORTON RESERVOIR

DATE _____

PROJECT FEATURE _____

NAME _____

AREA EVALUATED

CONDITION

OUTLET WORKS - TRANSITION AND CONDUIT

General Condition of Concrete

Rust or Staining on Concrete

Spalling

Erosion or Cavitation

Cracking

Alignment of Monoliths

Alignment of Joints

Numbering of Monoliths

NOT
APPLICABLE

INSPECTION CHECK LIST

PROJECT MORTON RESERVOIR

DATE _____

PROJECT FEATURE _____

NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u>	
a. Approach Channel	
General Condition	good
Loose Rock Overhanging Channel	none
Trees Overhanging Channel	none
Floor of Approach Channel	
b. Weir and Training Walls	
General Condition of Concrete	some spalling
Rust or Staining	some
Spalling	some
Any Visible Reinforcing	None
Any Seepage or Efflorescence	None
Drain Holes	None
c. Discharge Channel	
General Condition	fair
Loose Rock Overhanging Channel	none
Trees Overhanging Channel	none
Floor of Channel	good
Other Obstructions	debris & vegetation in channel

INSPECTION CHECK LIST

PROJECT NORTON RESERVOIR

DATE _____

PROJECT FEATURE _____

NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - CONTROL TOWER</u>	
1. Concrete and Structural	
General Condition	
Condition of Joints	
Spalling	
Visible Reinforcing	
Rusting or Staining of Concrete	
Any Seepage or Efflorescence	
Joint Alignment	
Unusual Seepage or Leaks in Gate Chamber	
Cracks	<u>NOT</u>
Rusting or Corrosion of Steel	<u>APPLICABLE</u>
2. Mechanical and Electrical	
Air Vents	
Float Wells	
Crane Hoist	
Elevator	
Hydraulic System	
Service Gates	
Emergency Gates	
Lightning Protection System	
Emergency Power System	
Wiring and Lighting System	

T

PROJECT FEATURE

NAME _____

INSPECTION CHECK LIST

PROJECT _____

DATE _____

PROJECT FEATURE _____

NAME _____

AREA EVALUATED

CONDITION

OUTLET WORKS - SERVICE BRIDGE

a. Super Structure

Bearings

Anchor Bolts

Bridge Seat

Longitudinal Members

Under Side of Deck

Secondary Bracing

Deck

Drainage System

Railings

Expansion Joints

Paint

b. Abutment & Piers

General Condition of Concrete

Alignment of Abutment

Approach to Bridge

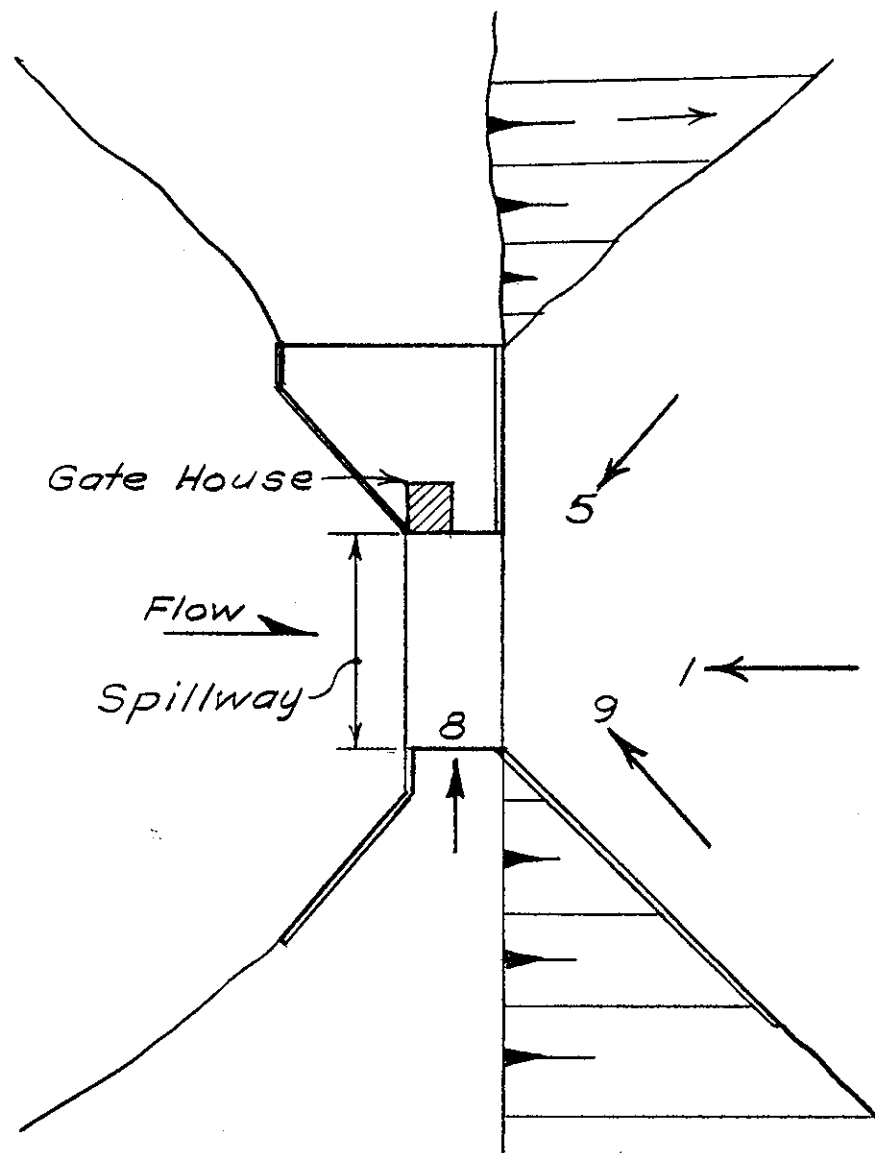
Condition of Seat & Backwall

NOTAPPLICABLE

APPENDIX B

No records of the design and construction
of this project were located.

APPENDIX C



Note:
Nos. denote
direction of Photos.

PLAN
NORTON RESERVOIR



8

Left Abutment Looking Across Spillway



9

Left Abutment Looking Across Apron



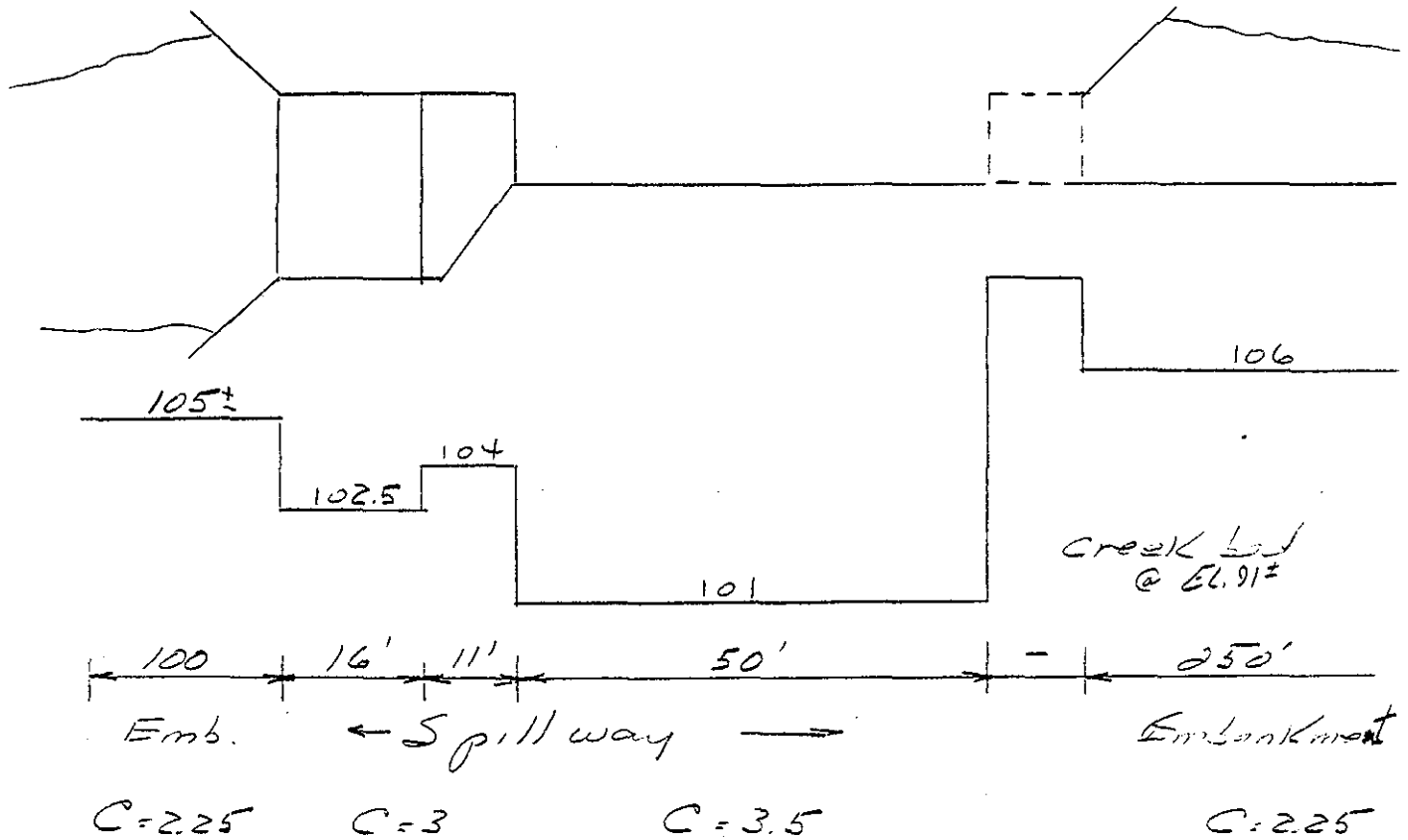
Downstream View of Dam



Right Bank Retaining Wall
looking Across Apron

APPENDIX D

PMF = 10,970 cfs - Q_{p1}
 Reservoir Area = 600 acres
 Drainage Area = 16.05 mi² = 10,270 acres



Surcharge to pass $Q_{p1} = 8.3'$

$$STOR_1 = \frac{600 \times 8.3 \times 12}{10,270} = 5.82''$$

$$Q_{p2} = Q_{p1} (1 - \frac{STOR_1}{19}) = 10,970 (1 - \frac{5.82}{19}) = 7,610 \text{ cfs}$$

Surcharge to pass $Q_{p2} = 7.3'$

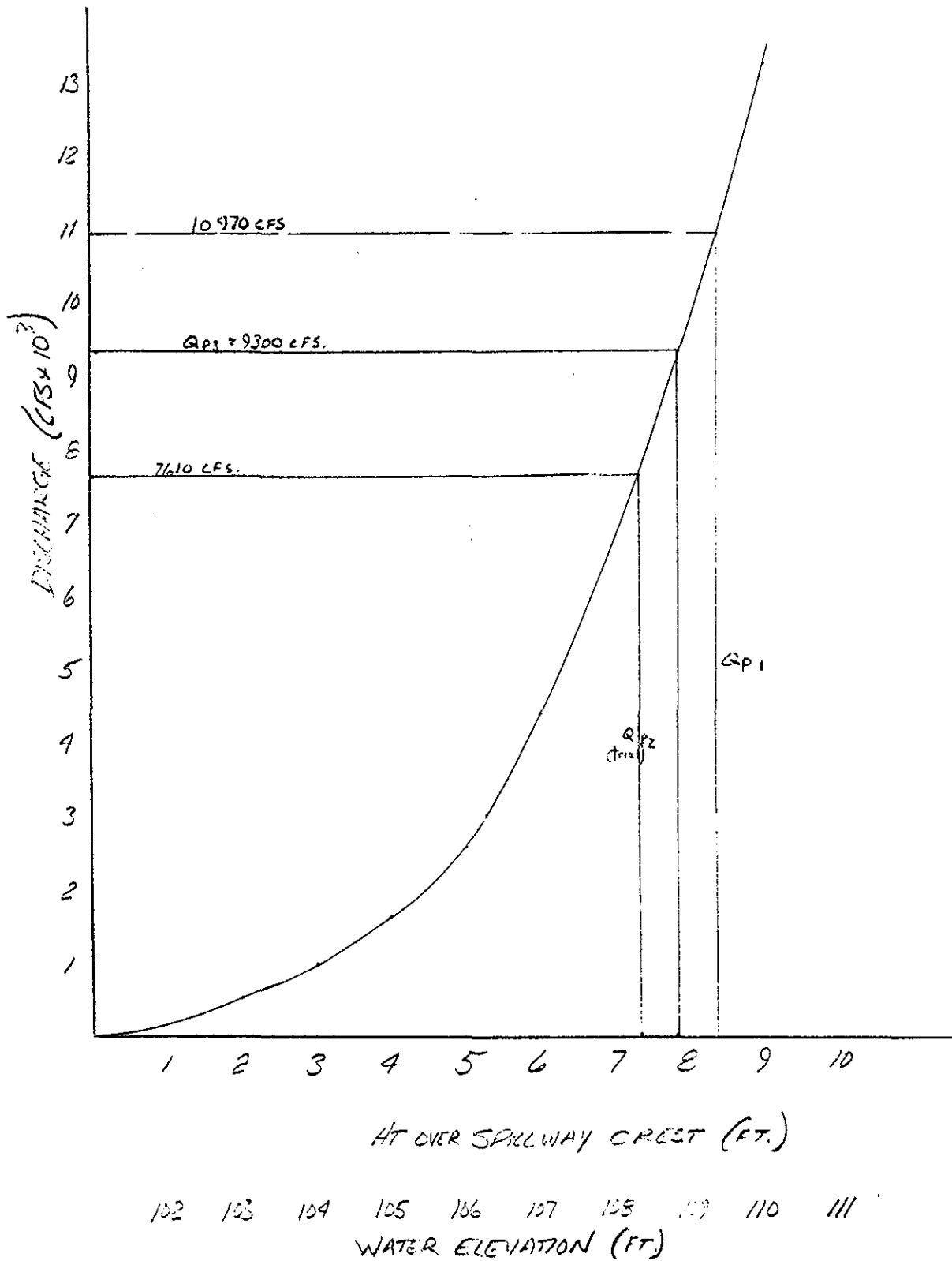
$$STOR_2 = \frac{600 \times 7.3 \times 12}{10,270} = 5.12'' \quad \text{Av } STOR = 5.47$$

$$\text{Av Surcharge} = 5.47 \times 10,270 / 600 \times 12 = 7.8' \quad Q_{p2} 9,300 \text{ cfs}$$

Client COF E
Subject NORTON

Job No. _____ Sheet 2 of _____
By J. VEITCH Date 27 JULY 1978
Ckd. _____ Rev. _____

CHECKED.



$$\text{STORAGE IN RES. (below CREST)} = 600 \text{ AC}(10') \cdot 5 = 3000 \text{ AC FT.}$$

PEAK FAILURE OUTFLOW $y_0 = 16'$
 $W_b = \text{ASSUMING } 50\% \text{ RIGHT BANK} = 50'$

$$Q_{P1} = \frac{8}{27} (50)(\sqrt{322})(16)^{1.5}$$

$$= 5,380 \text{ CFS.} + 1600 \text{ cfs} = 6980 \text{ cfs}$$

(TEST FLOOD)

USING RATING CURVES. p. 5

CASE I: PMF OVER DAM. (INTACT.)

REACH #1 $Q_{P1} = Q_{P3} = 9300 \text{ CFS.}$ EL. = 97.8'

$$V_1 = \frac{7.8}{11} \left(\frac{4175}{43560} \right) 1500 = 102 \text{ AC FT.}$$

$$Q_{P2} (\text{TRIAL}) = 9300 \left(1 - \frac{102}{3000} \right) = 8985 \text{ CFS.}$$

$$V_2 = \frac{7.6}{7.8} (102) = 99.4 \text{ AC FT.}$$

$$V_{\text{AVE}} = 100.7 \text{ AC FT.} \quad Q_{P2} = 9300 \left(1 - \frac{100.7}{3000} \right) = 8990$$

$$\text{EL.} = 97.7'$$

REACH #2 $8990 = Q_{P1}$ EL. 95.6

$$V_1 = \frac{7.6}{12} \left(\frac{7350}{43560} \right) 1000 = 106.9 \text{ AC FT.}$$

$$Q_{P2} (\text{TRIAL}) = 8990 \left(1 - \frac{106.9}{3000} \right) = 8665 \text{ CFS.} \quad \text{EL.} = 95.4.$$

$$V_2 = \frac{7.4}{7.6} (106.9) = 104.1 \text{ AC FT.} \quad V_{\text{AVE}} = 105.5 \text{ AC FT.}$$

$$Q_{P2} = 8990 \left(1 - \frac{105.5}{3000} \right) = 8675 \text{ CFS}$$

REACH #3 $Q_{P1} = 8675$ CFS EL. = 93.6

$$V_1 = \frac{6.6}{8} \frac{5300(1300)}{43560} = 130 \text{ ACFT}$$

$$Q_{P2}(\text{TRIAL}) = 8675 \left(1 - \frac{130}{3000}\right) = 8300 \text{ CFS} \Rightarrow \text{EL. } 93.3'$$

$$V_2 = \frac{6.3}{6.6} (130) = 124 \text{ ACFT} \quad \text{AVE} = 127 \text{ ACFT}$$

$$Q_{P2} = 8675 \left(1 - \frac{127}{3000}\right) = 8310 \text{ CFS}$$

REACH #4. $Q_{P1} = 8310$ CFS EL. = 90.9

$$V_1 = \frac{5.9}{10} \frac{(7900)1200}{43560} = 128 \text{ ACFT}$$

$$Q_{P2}(\text{TRIAL}) = 8310 \left(1 - \frac{128}{3000}\right) = 7955 \text{ CFS.} \Rightarrow \text{EL. } 90.7$$

$$V_2 = \frac{5.7}{5.9} (128) = 124 \text{ ACFT.} \quad V_{\text{AVE}} = 126 \text{ ACFT}$$

$$Q_{P2} = (8310) \left(1 - \frac{126}{3000}\right) = 7960 \text{ CFS.}$$

REACH #5 $Q_{P1} = 7960$
 $L = 160'$

$$V_{\text{AVE}} = \frac{16}{12} (126) = 168 \text{ ACFT}$$

$$Q_{P2} = 7960 \left(1 - \frac{168}{3000}\right) = 7515 \text{ CFS.}$$

ASSUMING CROSS STR. AS PR CRESTED WEIR (NEGLECTING CULVERT)

$$V \approx \frac{7515}{7900} \approx 1'/\text{sec.} \quad Q = CL \left(H + \frac{V^2}{2g}\right)^{1.5}$$

$$\sqrt[1.5]{\frac{7515}{25(900)}} - \frac{1^2}{64.4} = H = 3.8' \quad \therefore \text{WATER FL CROSSING.}$$

CROSS STR. REMAINING ≈ 90.9
 IN REACH #5.

REACH #1 WATER EL REACHES. 97.8' @ FLOW OF 9000 CFS.
LOW LYING HOMES AROUND DAM & COBBLE. SUBJECT
TO FLOODING.

#2 EL. 95.6 @ FLOW OF 8990 CFS. SLIGHT DANGER
OF PROPERTY DAMAGE TO SOME HOMES EAST OF
RESERVOIR AVE. NO SAFETY HAZARD.

#3 BY 5000' DOWNSTREAM OF DAM WATER CLEY DOWN TO
≈ 91.' CHANNEL OPENS TO LARGE, MARSH, FLOODPLAIN.
LITTLE PROPERTY DAMAGE POSSIBLE IN REACH #4

#5 WATER EL. REMAINING @ ≈ 91.' FLOODING A
FEW HOMES & FACTORY ON CORNER. NO APPARENT SAFETY
HAZARD.

Client COFE Job No. _____ Sheet 6 of _____
Subject NORTON RES. By J. VEITCH Date 20 JULY 1973
Ckd. _____ Rev. _____

CASE II P.F.O. $Q_{PI} = 6980$ CFS.
TO CURVES PP. 8 (neglecting Volume of channel)

REACH, EL. 95.6' Flooding to homes East side of
Cobb St. No hazard to life.

II. 93.7 Some flooding possible but unlikely.
No hazard.

III. 91.6 No Flooding or hazard.

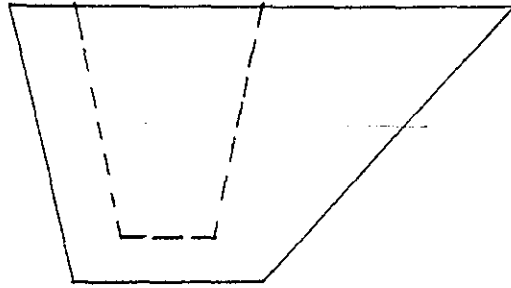
slope = $5/5000 \pm = .001 \pm$

1" = 300' horiz.

$S^{1/2} = .03$

$n = 0.05$

$C = 30$



WP's

AREAS

@ 100

@ 95

To 100

To 95

@ DAM

300

225

2,250

930

1500' distm.

800

575

6,100

2,600

Av. 550

400

4175

1765

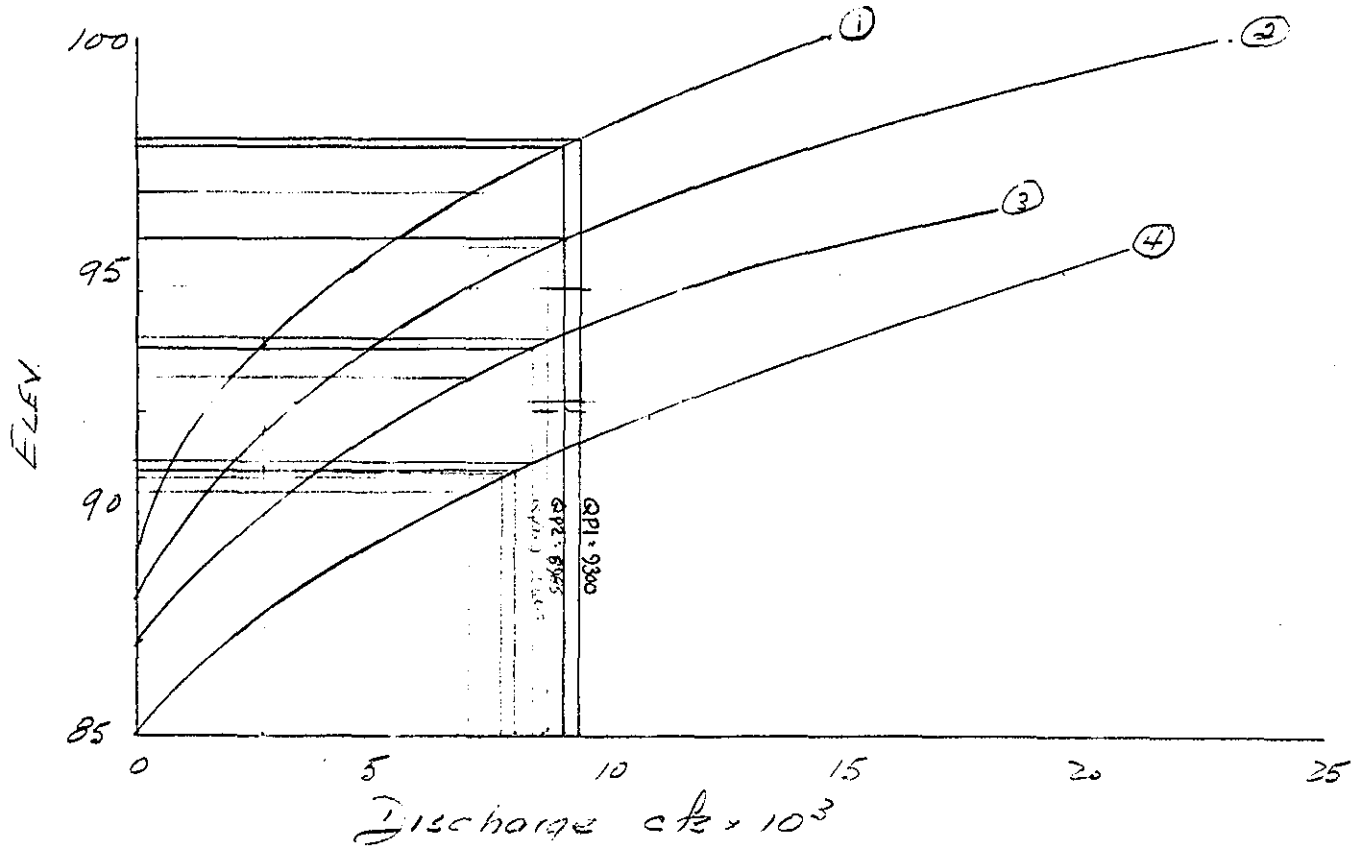
REACH ① 1500' long

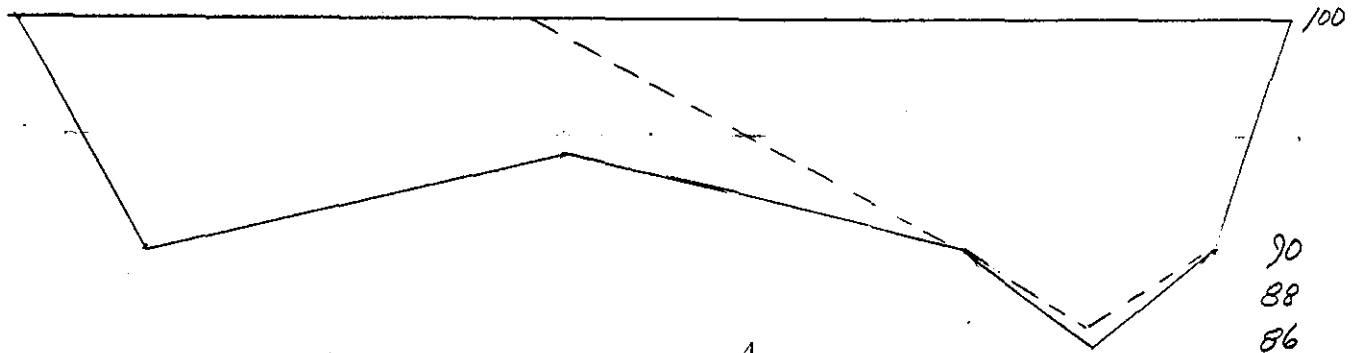
@ EL. 95 $TR = \frac{1765}{400} = 4.4$ $TR^{2/3} = 2.7$

$Q = A C R^{2/3} S^{1/2} = 1765 \times 30 \times 2.7 \times .03 = 4300 \text{ cfs}$

@ EL. 100 $TR = \frac{4175}{550} = 7.6$ $TR^{2/3} = 3.9$

$Q = 4175 \times 30 \times 3.9 \times .03 = 14,600 \text{ cfs}$





<u>WP's</u>		<u>AREAS</u>		
@ 100	@ 95	To 100	To 95	
1200	800	8,600	3,600	-- 2500' D.S.
2000	1850	16,600	7,000	— 3800 D.S.
Av. 1600	1325	12,600	5,300	Reach 3.
Av. 1000	700	7,350	3,100	Reach 2

REACH ②

$$@ EL 95 \quad R = \frac{3100}{700} = 4.4 \quad R^{2/3} = 2.7$$

$$Q = 3100 \times 30 \times 2.7 \times 0.3 = 7,500 \text{ cfs}$$

$$@ EL 100 \quad R = \frac{7350}{1000} = 7.35 \quad R^{2/3} = 3.5$$

$$Q = 7350 \times 30 \times 3.5 \times 0.3 = 23,000 \text{ cfs}$$

REACH ③

$$@ EL 95 \quad R = \frac{5300}{1325} = 4.0 \quad R^{2/3} = 2.6$$

$$Q = 5300 \times 30 \times 2.6 \times 0.3 = 12,400 \text{ cfs}$$

$$@ EL 100 \quad R = \frac{12600}{1600} = 7.9 \quad R^{2/3} = 3.9$$

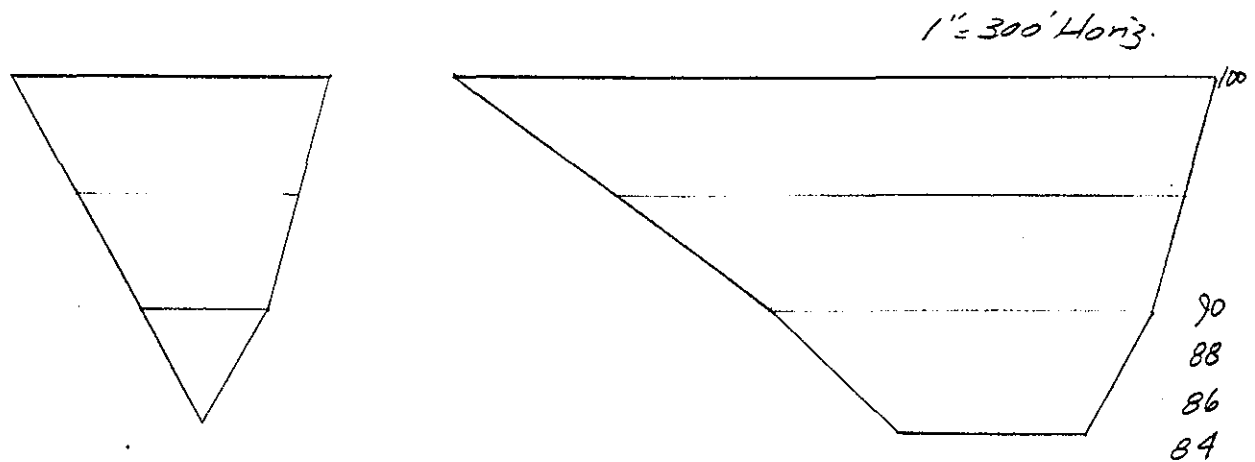
$$Q = 12,600 \times 30 \times 3.9 \times 0.3 = 44,000$$

REACH 3 (length = 1300')

$$V_1 = \frac{(7.6/8) 5300 \times 1300}{43,560} = 150 \text{ AF}$$

Total storage through REACH 3 = 400 AF

$$QP_2 (\text{trial}) = 11,500 \left(1 - \frac{9.6}{9400}\right) = 11,000$$



WP's		AREAS		5000 D.S.
@ 95	@ 90	To 95	To 90	
1250	800	7,900	2,750	
Av. 1550	400	7,450	1,400	Reach ④

REACH ④

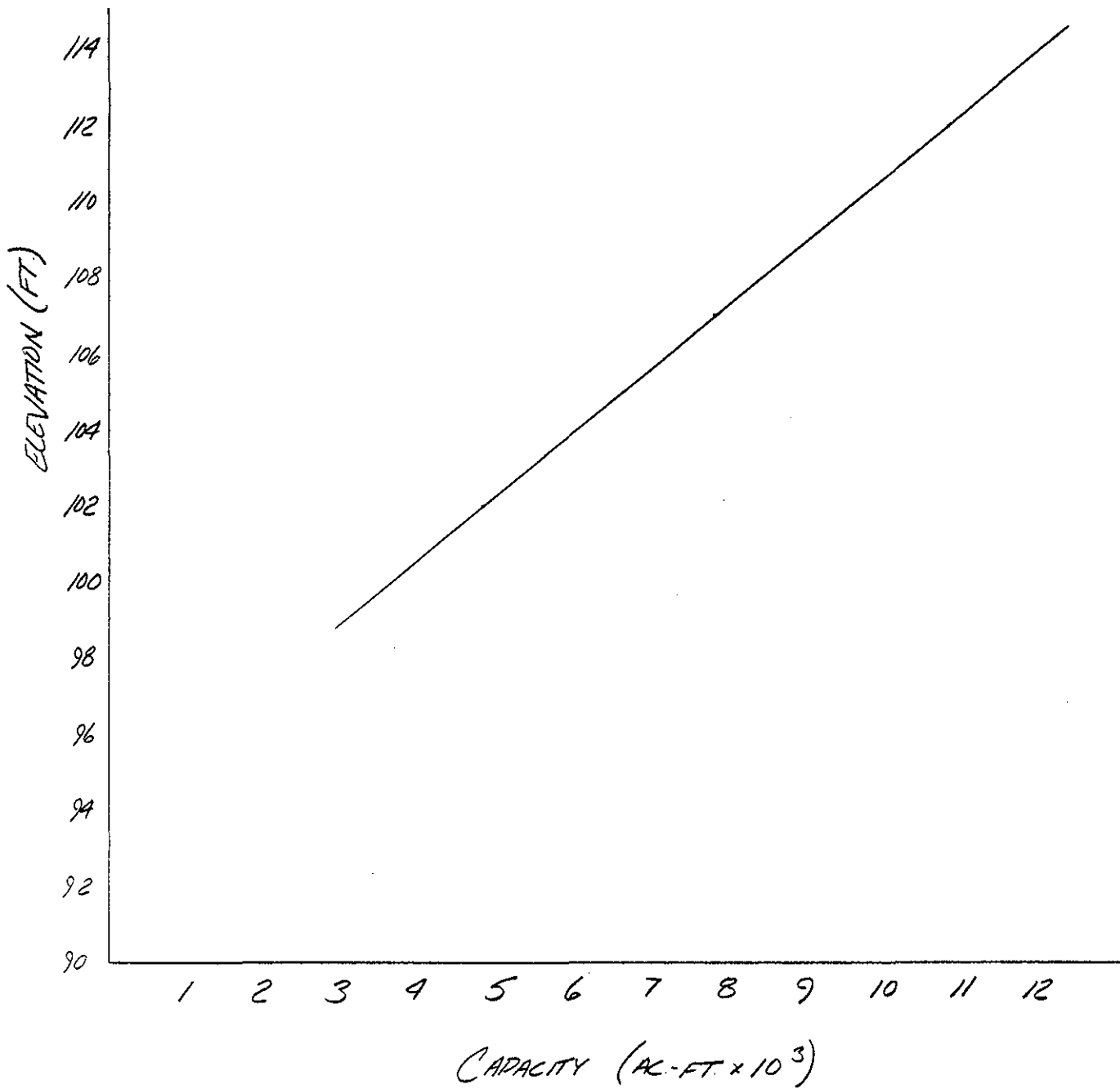
$$\text{C.E.L. } 90 \quad T_2 = \frac{1400}{400} = 3.5 \quad T_2^{2/3} = 2.5$$

$$Q = 1400 \times 30 \times 2.5 \times .03 = 3,100 \text{ cfs}$$

$$\text{C.E.L. } 95 \quad T_2 = \frac{7450}{1550} = 4.8 \quad T_2^{2/3} = 2.9$$

$$Q = 7450 \times 30 \times 2.9 \times .03 = 19,500 \text{ cfs}$$

Client C of E Job No. _____ Sheet 11 of _____
Subject NORTON RES. By J. VEITCH Date 25 AUG. 1978
- CAPACITY CURVE - Ckd. _____ Rev. _____



APPENDIX E
INFORMATION AS CONTAINED IN
THE NATIONAL INVENTORY OF DAMS



INVENTORY OF DAMS IN THE UNITED STATES

STATE	IDENTITY NUMBER	DIVISION	STATE	COUNTY	CONGR DIST.	STATE	COUNTY	CONGR DIST.	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE
MA	815	NED	MA	005	10				NORTON RESERVOIR DAM	4159.0		08SEP78

POPULAR NAME	NAME OF IMPOUNDMENT
	NORTON RESERVOIR

REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	DIST FROM DAM (MI.)	POPULATION
01	06	RUMFORD RIVER	NORTON	0	9500

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	IMPOUNDING CAPACITIES	DIST	OWN	FED	N	PRV/FED	SCS	A	VER/DATE
RECTPG	1900	0	17	12	MAXIMUM (ACRE-FT.) 3000 NORMAL (ACRE-FT.) 4500		NED	N	N	N	N		30AUG78

REMARKS

O/S HAS	CREST LENGTH	TYPE	WIDTH	MAXIMUM DISCHARGE (FT.)	VOLUME OF DAM (CY)	POWER CAPACITY	INSTALLED (MW)	PROPOSED (MW)	NO.	LENGTH	WIDTH	LENGTH	WIDTH	LENGTH	WIDTH	LENGTH	WIDTH
1	150	U	77	1650	6650												

OWNER	ENGINEERING BY	CONSTRUCTION BY
WADING RIVER RES. CORP.		

REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	NONE

INSPECTION BY	INSPECTION DATE	AUTHORITY FOR INSPECTION
CHAS. T. MAIN, INC.	DAY MO YR 12 JUN 78	P.L. 92-367

REMARKS